



Unité Expérimentale  
Recherche Intégrée  
Domaine de Gothon  
26320 Saint-Marcel-lès-Valence

**Arboriculture biologique :**  
**11 années d'expérimentation**  
**en vergers de pêchers et pommiers**

Résultats expérimentaux 1994-2004  
Suivi longitudinal  
Impact du mode de production



Partenariat : Agribiodrôme, GRAB

ALIMENTATION  
AGRICULTURE  
ENVIRONNEMENT

INRA



## Arboriculture biologique : 11 années d'expérimentation en vergers de pêchers et pommiers

Sylvaine Simon<sup>1\*</sup>, Claude Bussi<sup>1</sup>, Thierry Girard<sup>1</sup>, Nathalie Corroyer<sup>2</sup>

<sup>1</sup> INRA Gotheron - <sup>2</sup> GRAB

◆ adresse actuelle : [nathalie.corroyer@seine-maritime.chambagri.fr](mailto:nathalie.corroyer@seine-maritime.chambagri.fr)

**P**rogrammes et expérimentations réalisées sur le site de l'unité

### INRA Gotheron

Institut National de la Recherche Agronomique

Unité Expérimentale de Recherche Intégrée - 26320 SAINT MARCEL LES VALENCE - Tél. 04.75.59.92.00

en partenariat avec :

### Agribiodrôme

BP 17 - Avenue de la Clairette - 26150 DIE - Tél. 04.75.22.04.31 - mél : [agribiodrome@wanadoo.fr](mailto:agribiodrome@wanadoo.fr)

### GRAB

Groupe de Recherche en Agriculture Biologique

Site Agroparc - BP 1222 - 84911 AVIGNON Cédex 9 - Tél. 04.90.84.01.70 - mél : [arboriculture.grab@freesbee.fr](mailto:arboriculture.grab@freesbee.fr)

Ont contribué au programme "Optimisation des techniques en arboriculture biologique"

**Agribiodrôme** : J. Boccaccio, G. Ganivet, F.X. Getti (animateurs) ;

R. Carle, M. Combiér, GAEC Fauriel, S. Fauriel, G. Fressinet, J. Margerie, P. Mathieu, C. Panissod (producteurs) ;

**GRAB** : C. Bertrand, R. Desvaux, A.L. Domange, J. Fauriel, C. Gomez, G. Libourel, S.J. Ondet, L. Romet, F. Warlop ;

**INRA Gotheron** : C. Asencio, P. Asencio, R. Barbier, C. Bernard-Bruno, J. Besset, J. Beuffre, L. Brun, R. Chalamet, D. Chauffour, G. Clauzel, F. Combe, M. Cotte, V. Cotte, F. Cotte-Martinon, M. Debourg, H. Defrance, D. De Le Vallée, A. Duc, R. Dupland, A. Galet, L. Galet, O. Guibert, A. Jaubert, G. Lantheaume, G. Marboutie, F. Merlin, V. Mercier, S. Puléo, D. Riotord, X. Said, J.P. Tabardel, H. Virzi.

#### Merci à tous !

en particulier à Geneviève Ganivet (Agribiodrôme) pour son implication dans les débuts de cette démarche expérimentale collective en AB et à Agnès Jaubert pour la conception et la réalisation de cet ouvrage.

D'autres actions, conduites hors de ce programme sur les parcelles expérimentales AB de Gotheron, sont également présentées dans ce document ; elles constituent des travaux originaux appartenant aux auteurs mentionnés en début des chapitres correspondants.

Merci à :

Ministère de l'Ecologie et du Développement Durable  
INRA, Comité Interne pour l'Agriculture Biologique (Ciab)  
INRA - Action transversale "Production Fruitière Intégrée" (PFI)  
INRA - Action transversale "Production Intégrée des Cultures" (PIC)  
Société Manu Engrais Michut  
pour leur participation financière ou contribution à certaines actions du programme en AB de l'UERI Gotheron.

---

\* Coordination programme :  
S. Simon (INRA Gotheron)  
mél : [sylvaine.simon@avignon.inra.fr](mailto:sylvaine.simon@avignon.inra.fr)  
tél : 04.75.59.92.21

Réalisation document :  
A. Jaubert (INRA Gotheron)  
mél : [agnes.jaubert@avignon.inra.fr](mailto:agnes.jaubert@avignon.inra.fr)

## ABSTRACT

### Organic peach and apple production: an 11 year-experience of experimentation in orchards

A research program has been carried out for 11 years (1994-2004) in organic orchards at the INRA (National Institute for Agricultural Research) experimental station of Gotheron in the South-East of France. A local association for the development of organic farming (OF) (Agribiodrôme, F-26150 Die) and the GRAB (Research Institute for Organic Farming, F-84911 Avignon) also participated in the program. The aims were: (i) to acquire references about fruit organic farming; (ii) to identify and to analyse the key-problems of peach and apple organic production, in order to improve the management of organic orchards and/or to propose new experiments; and (iii) to assess on the long term the effect of organic farming on the soil and on the arthropod community of the orchard. Two peach orchards, one converted to OF and one planted under organic certification, and an apple orchard planted under organic certification constituted the experimental design.

As a perennial system with no crop rotation, fruit tree production presented various constraints for the management of the soil and the orchard protection. The low ability of our shallow soils to store and supply nutrients to fulfil the tree requirements implied: (i) to select appropriate types of fertilisers (i.e., compost, completed in spring with a quickly mineralised organic fertiliser); (ii) to adjust the doses and the timing of applications; (iii) to make additional supplies of some mineral elements (Mg, Mn, B) in the apple orchard. Although nitrogen supply was difficult to adjust to the tree requirements during the conversion period or in young orchards, this strategy allowed on the long term to improve the organic matter soil content, to preserve or to increase the availability of the soil nutrients, and to produce satisfying yield levels and fruit quality. Tillage within the row appeared to be disruptive for tree roots, above all when changing from chemical to mechanical weed control (i.e., when converting from conventional to OF production). The survey of the nitrogen content of the soil solution at different depth also allowed to assess that there was no risk of nitrogen leaching, and therefore of nitrogen pollution, under our fertilisation management regime.

Most probably due to a balanced fertilisation regime and a non-disruptive pest management, some pests, such as mites, peach aphids,... were naturally controlled. Mating disruption and microbiological insecticides provided control of oriental moth and codling moth. But the control of some other diseases or pests in our orchard systems either depended on large amounts of active ingredients presenting side effects, and/or was insufficient. For example, the control of the leaf curl disease due to *Taphrina deformans*, which relies on the sole use of copper fungicides, could be a key-problem because of the length of the peach tree susceptible period (6 to 7 weeks). Post harvest decay diseases of peaches were also difficult to manage by sanitation practices only. In the apple orchard, the most prevailing pest was the apple rosy aphid *Dysaphis plantaginea* which proved to be very difficult to control and could damage seriously trees and fruits. Failure in aphid control is likely to have emphasised the alternate fruit bearing that occurred in the apple orchard from 2001 onwards. Centrifugal training, which is a recent tree training concept based on tree physiology, partially limited the development of this pest.

The survey of the arthropod community in the apple organic orchard (2001-2003) showed a higher biomass and a different structure of the arthropod beneficial complex (mainly polyphagous predatory arthropods), compared to other conventionally grown orchards. The populations of secondary pests did not increase along the 11 year-survey for both peach and apple productions. But, due to the use of copper and sulphur, side effects on the soil fauna and the arthropod beneficial complex may be caused.

Because of the low efficiency and/or the potential side effects of some plant protection products used in OF, it is therefore important to design the organic orchard so that it does not rely heavily on plant protection inputs; according regions, the choice of low susceptible cultivars, large tree spacing, plant environment management, and the use of sanitation practices... are important criteria to produce organic fruits in sustainable systems.

**Key-words:** organic farming, fruit tree production, apple, peach, soil management, organic fertilisation, plant protection, orchard system, arthropod community



Ce document présente les expérimentations et le suivi longitudinal réalisés de 1994 à 2004 en vergers expérimentaux conduits en Agriculture Biologique sur le site de l'Unité expérimentale de l'INRA Gotheron, en partenariat avec la profession (Agribiodrôme) et le Groupe de Recherche en Agriculture Biologique (GRAB). Il constitue un témoignage et un document de synthèse sur les travaux de recherche entrepris en arboriculture biologique, leur spécificité et leurs perspectives.